APPLICATION OF TRANEXAMIC ACID INTRAVENOUS DRIP BEFORE INTERNAL FIXATION IN THE TREATMENT OF ELDERLY PATIENTS WITH UNSTABLE INTERTROCHANTERIC FRACTURE

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ABSTRACT

Objective*: To investigate the application effect of tranexamic acid intravenous drip before internal fixation in elderly patients with unstable intertrochanteric fracture.*

Methods: *A total of 136 elderly patients with unstable intertrochanteric fracture admitted to our hospital from January 2018 to June 2020 were chosen and divided into two groups by the random number table, with each group including 78 cases. The experimental group was given tranexamic acid intra-venous injection before operation, while the control group was not given tranexamic acid intravenous injection before operation. The baseline clinical data, perioperative blood transfusion rate, perioper-ative blood loss volume, postoperative drainage volume, preoperative and postoperative laboratory indicators and safety indicators of 2 groups were compared.*

Results: *There was no significant difference in baseline clinical data between 2 groups (P>0.05). The perioperative blood transfusion rate, total blood loss volume and hidden blood loss volume of experimental group were significantly less than those of control group (P<0.05). There was no sig-nificant difference in the volume of explicit blood loss and postoperative drainage between 2 groups (P>0.05). There was no significant difference in levels of Hb and HCT between 2 groups before and at 7d after operation (P>0.05). The levels of Hb and HCT of experimental group were significantly higher than those of control group at 1d, 3d and 5d after operation (P<0.05). There was no significant dif-ference in the incidence of intramuscular venous thrombosis between 2 groups (P>0.05). No severe thrombus-related complications such as deep venous thrombosis (DVT), pulmonary embolism (PE) and ischemic stroke occurred.*

Conclusion: *Tranexamic acid intravenous drip before internal fixation in the treatment of elderly patients with unstable intertrochanteric fracture can effectively control the perioperative blood loss volume, especially the hidden blood loss, with good safety and clinical application value.*

Keywords: *Internal fixation, tranexamic acid, elderly, intertrochanteric fracture.*

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Introduction

Intertrochanteric fracture most likely occurs in elderly people, and is often caused by tumbling. It is reported that, unstable fractures accounts for more than 35% of such fractures[1]. Due to the aggravation of population aging, the morbidity of intertrochanteric fracture and the number of patients are increasing year by year[2]. Proximal femoral nail anti-rotation (PFNA) has been widely applied in the treatment of multiple types of intertrochanteric fracture in recent years. Foreign studies show that, postoperative blood loss of PFNA usually exceeds 800ml and the blood loss volume of unstable fracture even reaches 1000ml, mainly including hidden blood loss. A large amount of blood transfusion during the perioperative period is likely to lead to the increase of surgical risks such as immune hemolytic reaction and infec-

tious disease[3]. Tranexamic acid belongs to a plasmin inhibitor of lysine derivative type and can effectively inhibit protease degradation, which has been verified to reduce perioperative blood loss volume[4]. A total of 136 elderly patients with unstable intertrochanteric fracture admitted to our hospital from January 2018 to June 2020 were included in this study to explore the application effect of tranexamic acid intravenous drip before internal fixation in elderly patients with unstable intertrochanteric fracture.

Materials and methods

Demographics

A total of 136 elderly patients with unstable intertrochanteric fracture admitted to our hospital from January 2018 to June 2020 were chosen and divided into two groups by the random number table, with each group including 78 cases. The experimental group was given tranexamic acid intravenous injection before operation, while the control group was not given tranexamic acid intravenous injection before operation.

Inclusion criteria:

• Definitely diagnosed as intertrochanteric fracture;

• AO type was AO 2.2/2.3/3;

• Age ≥70 years; unilateral closed fracture.

Exclusion criteria:

• Had allergic history of tranexamic acid or relevant contraindications;

• Pathological fracture;

• Abnormal coagulation function prior to the operation;

• Took anticoagulant drugs in recent 4 weeks;

• Accompanied with intra-articular fracture;

• Hip surgery history;

• Refused to cooperate.

The research scheme conformed to the requirements of Declaration of Helsinki, and patients or their family members were informed and consented.

Methods

The operation was completed by the same surgeon, and general anesthesia or epidural anesthesia was performed. The surgical incision was from the greater trochanter of femur to the tip of the greater trochanter, with the length of about 6-8cm.

The guide pin was placed in the medullary space via the incision under X-ray perspective, and PFNA-II main nail was inserted after proximal medullary space expansion. The spiral guide pin was screwed in with the help of the proximal sighting device, and the tip-apex distance was ensured within 30mm. After the screw blade was punched in, the interlocking screw was placed with the help of the proximal sighting device, and the alignment of the fracture end was confirmed to be satisfactory. Finally, the operative region was thoroughly washed with normal saline and the incision was sutured. Tranexamic acid was not used in the control group.

The experimental group was given tranexamic acid intravenous injection 30min before operation, with the dose of 20mg/kg. After operation, the drainage tube was routinely occluded for 120min. The patients conducted functional exercise in the bed at 2d after operation.

The patients with extramedullary fixation walked on ground with other's help at 14d after operation, and those with intramedullary fixation walked on ground at 7d after operation. Besides, they received intravenous drip of low molecular heparin for 7d. After discharge, they continued to take rivaroxaban orally for 4 weeks.

Outcome measure

The baseline clinical data, blood loss volume, blood transfusion rate, postoperative drainage volume, laboratory indicators in the perioperative period and safety indicators were recorded by looking up case records. Blood transfusion criteria[5]: Hb<70g/L, over 90g/L after correction, 1U red cells transfusion was guaranteed to amount to 200ml.

Blood loss volume included aspirator and gauze, and the blood loss volume was calculated according to Cross equation. The calculation formula of operative blood loss volume was preoperative blood volume (preoperative Hct + operative Hct).

The calculation formula of explicit blood loss volume was negative pressure drainage volume + postoperative 3d drainage volume + amount of bleeding from dressing[6]. Severe thrombus-related complications such as deep venous thrombosis (DVT), pulmonary embolism (PE) and ischemic stroke were recorded.

Statistical processing

SPSS22.0 software was used to analyze data. LSD-t test was used for inter-group comparison of measurement data meeting normal distribution, expressed with ($\bar{x}\pm s$). Enumeration data were compared with χ^2 test or Fisher exact probability method, expressed with %. $P<0.05$ was considered to be significantly different.

Results

Comparison of baseline clinical data between 2 groups

There was no significant difference in baseline clinical data between 2 groups (P>0.05), as shown in Table 1.

Group	No.	Gender		Age (year)	Position		Reasons for fracture			Underlying diseases			Operation time (min)	D-D (mg/L)
		Male	Female		Left	Right	Tumble	Traffic	Others	Hypertension	Diabetes	Others		
Control group	78	40	38	76.94±5.42	31	47	59	12	7	27	19	10	112.27±38.59	38.61±5.10
Experimental group	78	43	35	77.69±5.60	33	45	63	10	5	30	15	12	111.73±36.47	37.25±4.68
t/χ^2		0.31		0.43	1.37		1.10			0.89			0.55	0.27
P		0.76		0.57	0.60		0.75			0.84			0.50	0.81

Table 1: Comparison of baseline clinical data between 2 groups.

Comparison of perioperative blood transfusion rate and blood loss volume between 2 groups

The perioperative blood transfusion rate, total blood loss volume and hidden blood loss volume of experimental group were significantly less than those of control group (P<0.05). There was no significant difference in the volume of explicit blood loss and postoperative drainage between 2 groups (P>0.05), as shown in Table 2.

Group	No.	Perioperative blood transfusion rate [n,%]	Total blood loss volume (ml)	Hidden blood loss volume (ml)	Explicit blood loss volume (ml)
Control group	78	28 (35.90)	937.20±119.30	774.81±46.82	164.40±42.61
Experimental group	78	5 (6.41)	764.59±107.74	592.37±40.34	156.72±38.96
t/χ^2		16.39	17.97	20.81	1.33
P		0.00	0.39	0.53	0.28

Table 2: Comparison of perioperative blood loss volume, postoperative drainage volume and blood transfusion rate between 2 groups.

Comparison of postoperative drainage volume between 2 groups

The postoperative drainage volume of control group and experimental group was (97.61±15.75) ml and (95.88±14.20)ml, respectively. There was no significant difference in the postoperative drainage volume between 2 groups (P>0.05).

Comparison of perioperative laboratory indicators between 2 groups

There was no significant difference in levels of Hb and HCT between 2 groups before and at 7d after operation (P>0.05). The levels of Hb and HCT of experimental group were significantly higher than those of control group at 1d, 3d and 5d after operation (P<0.05), as shown in Table 3.

Comparison of safety indicators between 2 groups

Color Doppler ultrasound of lower extremity blood vessels reexamined at 5d and 4w after operation showed that there were 4 cases and 2 cases of intramuscular venous thrombosis in the control group and the experimental group respectively, with the incidence of 5.13% and 2.57% respectively. There was no significant difference in the incidence of intramuscular venous thrombosis between 2 groups (P>0.05). They improved after oral administration of antithrombotic drugs, and no severe thrombus-related complications such as deep vein thrombosis (DVT), pulmonary embolism (PE), and ischemic stroke were found.

		Hb (g/L)					Hct (%)				
		Before operation	After operation 1d	3d after operation	5d after operation	7d after operation	Before operation	After operation 1d	3d after operation	5d after operation	7d after operation
Experimental group	78	106.46± 10.94	95.40± 13.66	87.65± 11.84	85.20± 10.93	84.33± 9.43	38.62± 0.33	31.06± 2.61	28.06± 2.90	27.89± 3.44	28.04± 3.88
Control group	78	107.4312.62	81.94± 10.35	74.22± 8.67	77.13± 9.40	82.76± 10.26	38.44± 0.29	28.19± 2.35	25.34± 3.57	24.48± 2.95	26.89± 3.60
t		0.69	4.17	3.55	5.81	0.62	0.86	5.46	5.79	5.20	1.07
P		0.85	0.02	0.04	0.00	0.88	0.62	0.00	0.00	0.00	0.40

Table 3: Comparison of perioperative laboratory indicators between 2 groups.

Discussion

In recent years, there have been increasing reports of hidden blood loss in perioperative period of elderly patients with intertrochanteric fractures, but the specific mechanism of action is still unclear[7]. Some studies show that[8], the explicit blood loss volume in the treatment of intertrochanteric fracture by PFNA is less than that in the treatment of intertrochanteric fracture by other internal fixations, but the hidden blood loss volume is often more. Besides, the proportion of hidden blood loss volume increases continuously with the increase of fracture severity.

It is believed that the hidden blood loss volume in the perioperative period may be related to the following factors[9, 10]: perioperative blood permeates in tissue space and coagulates rapidly, and cannot enter blood; capillary regulation capability is reduced and soft tissues relax so that tissue fluid cannot flow back in time. Thus, explicit blood loss volume decreases and hidden blood loss volume increases; anesthesia or surgical medullary space expansion results in massive destruction of red blood cells, and hemolysis reduces the body's blood volume. To ensure the blood supply of vital organs such as the heart and brain, the skin muscle vessels continue to contract postoperatively, thus leading to the delay of healing at the incision and fracture part. Meanwhile, the risks of relevant complications increase[11].

Tranexamic acid is a kind of synthetic anti-fibrinolytic drugs, which can stimulate the close adsorption of affinity site and lysine binding site of fibrin on plasmin and plasminogen, antagonize plasmin, plasminogen and fibrin binding, influence fibrous protein decomposition and reduce fibrinolytic activity, thus giving play to the purpose of stop bleeding and reducing the amount of bleeding[12]. The reports of foreign scholars have verified that[13], intravenous administration of tranexamic acid can reduce the hidden blood loss volume and transfusion rate during the perioperative period of joint replacement, without the increase of thrombosis risk. Elderly patients with unstable intertrochanteric fracture have poor surgical tolerance due to older age and multiple internal medical diseases. Thus, the patients in the study excluded those with severe cardiovascular and cerebrovascular diseases and coagulation disorders[14]. It is also reported that[15, 16], intravenous administration of 1-1.5g tranexamic acid at a single time and twice 30min before treatment of elderly fracture patients by PFNA can lower blood loss volume (mainly hidden blood loss) and blood transfusion rate, without the increase of relevant complications. In previous studies, most include all types of fracture, this study only included elderly patients with intertrochanteric fracture, and the blood loss volume in the perioperative period was more than that of other stable types.

In the results of this study, the perioperative blood transfusion rate, total blood loss volume and hidden blood loss volume of experimental group were significantly less than those of control group ($P<0.05$). The levels of Hb and HCT of experimental group were significantly higher than those of control group at 1d, 3d and 5d after operation ($P<0.05$). Such results comply with previous results[17]. The author observed that, the minimum values of Hb and HCT after operation mostly appeared at 3-5d, and they became stable at about 7d. This phenomenon may be related to the following factors: fluid concentration caused by trauma or surgery has been basically corrected, and the hematopoietic function of the elderly has not played its role due to the decrease of hematopoietic ability[18]. It should be noted that the total blood loss volume and hidden blood loss volume of control group and experimental group in the perioperative period in were both higher than the results in previous reports. The author considered the reason for this difference may be that the patients belonged to unstable intertrochanteric fracture and involved longer operation time and severer soft tissue injury so that the total blood loss volume in the perioperative period was more.

The study also has some limitations: the number of cases was small, and the study was a monocentric study; BMI needed to be assessed for the calculation of blood loss volume, while the calculation data of elderly patients with intertrochanteric fracture had some deviation due to long-term bed; the time for follow-up visit was short, and there was lack of long-term efficacy assessment and safety data, so a further study is required to verify the conclusion.

In conclusion, Tranexamic acid intravenous drip before internal fixation in the treatment of elderly patients with unstable intertrochanteric fracture can effectively control the perioperative blood loss volume, especially the hidden blood loss, with good safety and clinical application value.

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